Local fabric density in L2 vertebral body bone by high contrast resolution x-ray microtomography.

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Many x-ray microtomography.(XMT) studies of human vertebral bone samples have been conducted, but none with high quality, high contrast resolution methodology, which necessarily requires long integration times and, therefore, stable samples. We accessed a collection of 69 ~2mm thick, parasagittal sections of L2 vertebral bodies which were preserved - by embedding in PMMA - under the aegis of the BioMed 1 European [long before Brexit] project [Bone quality in osteoporosis]. Prior studies using quantitative backscattered electron [qBSE-SEM] imaging had shown a wide spread of local mineralisation density values when sampled at one cubic micrometer [1 fl] resolution, but only in 2D section planes. To acquire 3D data, we used the QMUL MuCAT2 TDI microtomography system at 30 micron voxel size, 90kV, typically 72h scan time, each scan corrected for beam-hardening and calibrated with a multi-metal calibration carousel: Linear Attenuation Coefficient (LAC) accuracy better than 2%. Results shown are expressed in LAC (cm-1), equivalence to assumed HA concentration.
Analysis using ImageJ Fiji. To avoid partial volume artefacts, we stripped, in 3D, one voxel from all free bone surfaces. We compared distributions for the whole bone slab and regions selected to contain only internal trabecular bone, avoiding cortices and end plates. Both showed extreme ranges, but whole slab values contained a higher proportion of highest density voxels. These results are in complete agreement with the earlier qBSE-SEM data which showed the highest values in calcified cartilage in end plates and calcified ligamentous inclusions and Sharpey fibre bone rich regions in cortices, NB the anterior cortex. 'Bone' in the vertebral body is not one tissue but has a variety of fabrics and fabric densities.

Poster presentation in Muscle and Bone session

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